Chemical behavior of U(VI), Am(III) and Sr(II) in the washing of HLW sludges

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To understand the behavior of radionuclides during alkaline pretreatment of tank sludges, simulants were prepared according to the BiPO4, Redox and PUREX processes and incorporated with U-233, U-238, Am-243 or Sr-90. The simulated sludges were washed with solutions of various compositions - acidic, alkaline, or with chelating agents. Spectroscopic techniques including UV/Vis, fluorescence, NMR and EXAFS provided additional information on the speciation. A combination of selective leaching of uranium in the presence of oxalate and malonate and NMR experiments demonstrated the competition between complexation and hydrolysis. Limited experiments with Co-60 radiation were performed to evaluate the effect of radiolysis on the leaching. Preliminary experiments were conducted to study the oxidative leaching of americium from the sludge, using $S_2O_8^{2-}$ as the oxidant. These data help to predict the behavior of radionuclides in sludge washing and improve the washing strategies.

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